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**H01L 33/00**(21) Application number: **2001069512**(22) Date of filing: **12.03.01**(71) Applicant: **CITIZEN ELECTRONICS CO LTD**(72) Inventor: **NAGAYAMA MAKOTO**(54) **LIGHT EMITTING DIODE AND ITS MANUFACTURING METHOD**

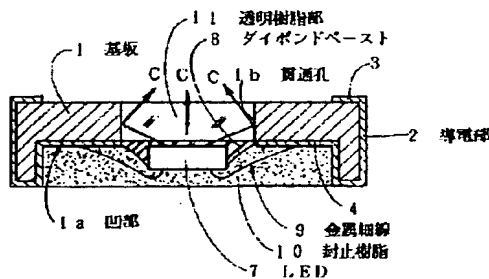
(57) Abstract:

**PROBLEM TO BE SOLVED:** To solve the problem that an LED deteriorates in brightness because light emitted from the LED leaks in the lateral direction, penetrating through a light transmitting board.

**SOLUTION:** Through-holes are provided in rows on an aggregate board, and a stepped through-hole 1b with a recess 1a is provide between the rows of the through-holes. An upper electrode 3, a lower electrode 4, and a through-hole electrode 2 (conductive part) are provided on the board, the rear opening of the through-hole 1b is stopped up with a tape or the like, then light transmitting resin fills up the through-hole and is cured, an LED 7 is die-bonded on the light transmitting resin 11 with light transmitting die bonding paste 8 covering the side of the LED 7, the LED 7 is wire-bonded with metal fine wires 9, and sealing resin 10 is made to fill up the recess 1a so as to cover the LED 7 and the metal fine wires 9. Cut lines are provided passing through centers of the through-holes, and other cut lines are provided crossing the cut lines at right angles, the aggregate board is cut into unit light emitting diodes along the latter cut lines. The through-holes are sloped, and a reflecting film is

formed on the slope. The light emitting diodes can be improved in brightness and made inexpensive because they are thin and formed in a lot.

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(22)Date of filing : 12.03.2001 (72)Inventor : NAGAYAMA MAKOTO

**(54) LIGHT EMITTING DIODE AND ITS MANUFACTURING METHOD**

**(57)Abstract:**

PROBLEM TO BE SOLVED: To solve the problem that an LED deteriorates in brightness because light emitted from the LED leaks in the lateral direction, penetrating through a light transmitting board.

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CLAIMS

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[Claim(s)]

[Claim 1] Form the breakthrough with a stage characterized by providing the following, and fill up with and harden translucency resin and the translucency resin section is formed in a part for this penetration pore. Die bond of the light emitting diode is carried out to this translucency resin section so that the side face of a light emitting diode may be covered with the die bond paste of translucency. The light emitting diode which carries out wire bond of the top-face electrode of this light emitting diode, and the electrode formed in the crevice of said substrate with a metal thin line, and is characterized by filling up with and hardening closure resin in said crevice so that said light emitting diode and a metal thin line may be covered The substrate which has connected the electrode of a vertical side by the current carrying part of a side face It is a crevice to the abbreviation center section of this substrate.

[Claim 2] The configuration of a breakthrough according to claim 1 is light emitting diode characterized by having the slant face expanded in the shape of a parabola as it goes to the outlet of a hole, and forming the reflective film in the slant face of this breakthrough.

[Claim 3] The manufacture approach of light emitting diode characterized by providing the following The set substrate processing process which is on the flat surface of the set substrate which consists of a glass epoxy resin which takes and is carried out, carries out two or more trains arrangement of two or more through holes so that it may arrange in the shape of a grid, and forms in the abbreviation center section between each train the breakthrough with a stage which has a crevice [ many ] The electrode pattern formation process which forms an electrode pattern in the vertical side of a set substrate including the inner surface of said through hole The translucency resin section formation process which fills up with and hardens translucency resin at a part for a penetration pore after a tape etc. closes a hole at the rear face of said breakthrough The mounting process which carries out die bond of the light emitting diode to said translucency resin section so that the side face of a light emitting diode may be covered with the die bond paste of translucency, The bonding process which carries out wire bond of the top-face electrode of said light emitting diode, and the electrode formed in the crevice of a set substrate with a metal thin line, The resin seal process which fills up with and hardens closure resin in said crevice so that said light emitting diode and metal thin line which were mounted may be covered, The division process which cuts along with the cutline which passes along the core of the through hole of a set substrate by the dicing machine or the slicing machine, and the cutline which intersects perpendicularly with this cutline and passes along the center between through holes, and is divided into the light emitting diode of a single individual

[Claim 4] The configuration of a breakthrough according to claim 3 is the manufacture approach of the light emitting diode characterized by having the slant face expanded in the shape of a parabola as it goes to the outlet of a hole, and forming the reflective film in this slant face.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the light emitting diode used for various kinds of electronic equipment, and its manufacture approach.

[0002]

[Description of the Prior Art] There is an application for patent 2000-317237 "filing date of application and October 17, Heisei 12" for which these people applied previously in light emitting diode as package structure of light emitting diode where it packed in the form of being suitable for the surface mount to the circuit board, by mounting in a substrate, closing by the resin of translucency, and preparing a connection terminal. The outline is explained based on drawing 11.

[0003] In drawing 11, the substrate 1 which carried out the abbreviation rectangle configuration is a resin substrate which consists of a glass epoxy resin etc., and the current carrying part 2 of a side face is the side-face electrode which made the radii configuration which made the through hole abbreviation one half, and it has connected the electrodes 3 and 4 of the vertical side formed on the substrate 1 by this current carrying part 2. Breakthrough 1 with stage b which has crevice 1a is formed in the abbreviation center section of said substrate 1. Although said substrate 1 is divided into the substrates 1A and 1B of the body according to right and left by breakthrough 1b, two substrates 1A and 1B currently divided are combined by joining ranging over two substrates 1A and 1B using adhesives 6 grade, as the base substrate 5 of translucency closes breakthrough 1b.

[0004] On the base substrate 5 of said translucency, into breakthrough 1b of a substrate 1, die bond of the light emitting diode (it is hereafter written as LED) 7 is carried out so that the side face of LED7 may be covered with the die bond paste 8 of translucency. Wire bond of said LED7 and the electrode 4 formed in crevice 1a of a substrate 1 is carried out with the metal thin line 9, and crevice 1a is made to fill up with and harden closure resin 10 so that said LED7 and the metal thin line 9 may be covered.

[0005] Like for example, sapphire glass or silicon carbide, transparently, the construction material of the base substrate 5 of said translucency is the good ingredient of heat dissipation nature, and radiates heat in the heat generated from LED7.

[0006] Moreover, as said closure resin 10, for example like silicon, the white resin of high reflexivity is good at lightfastness, and if powder, such as an alumina, is further mixed in this, heat dissipation nature will improve.

[0007] The surface mount of the light emitting diode is carried out to the circuit board of an assembly place with the electrode 4 formed in the underside by the above-mentioned configuration. As shown in drawing 11, although the light emitted from LED7 comes out from the side face of LED7 to a longitudinal direction like an arrow head A, it reflects by the interface of the die bond paste 8 of translucency, and closure resin 10, and it is emitted from the base substrate 5 of translucency.

[0008]

[Problem(s) to be Solved by the Invention] However, there are the following troubles in the light emitting diode mentioned above. That is, in order for a part of light emitted from LED to leak to the longitudinal direction of the base substrate of translucency, there was a fault to which brightness falls.

[0009] This invention is made in view of the above-mentioned conventional technical problem, the object is the thin shape used for electronic equipment, and improvement in brightness can be performed and it offers the light emitting diode and its manufacture approach of a cheap surface mount mold.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned object, the light emitting diode in this invention The breakthrough with a stage which has a crevice is formed in the abbreviation center section of the substrate which has connected the electrode of a vertical side by the current carrying part of a side face, and this substrate. Fill up with and harden translucency resin and the translucency resin section is formed in a part for this penetration pore. Die

bond of the light emitting diode is carried out to this translucency resin section so that the side face of a light emitting diode may be covered with the die bond paste of translucency. Wire bond of the top-face electrode of this light emitting diode and the electrode formed in the crevice of said substrate is carried out with a metal thin line, and it is characterized by filling up with and hardening closure resin in said crevice so that said light emitting diode and a metal thin line may be covered.

[0011]Moreover, the configuration of a breakthrough according to claim 1 has the slant face expanded in the shape of a parabola as it goes to the outlet of a hole, and it is characterized by forming a reflective member in the slant face of this breakthrough.

[0012]Moreover, it is on the flat surface of the set substrate which consists of a glass epoxy resin which takes and is carried out. [ many ]The set substrate processing process which carries out two or more trains arrangement of two or more through holes so that it may arrange in the shape of a grid, and forms in the abbreviation center section between each train the breakthrough with a stage which has a crevice, The electrode pattern formation process which forms an electrode pattern in the vertical side of a set substrate including the inner surface of said through hole, The translucency resin section formation process which fills up with and hardens translucency resin at a part for a penetration pore after a tape etc. closes a hole at the rear face of said breakthrough, The mounting process which carries out die bond of the light emitting diode to said translucency resin section so that the side face of a light emitting diode may be covered with the die bond paste of translucency, The bonding process which carries out wire bond of the top-face electrode of said light emitting diode, and the electrode formed in the crevice of a set substrate with a metal thin line, The resin seal process which fills up with and hardens closure resin in said crevice so that said light emitting diode and metal thin line which were mounted may be covered, The cutline which passes along the core of the through hole of a set substrate by the dicing machine or the slicing machine, It is characterized by consisting of a division process which cuts along with the cutline which intersects perpendicularly with this cutline and passes along the center between through holes, and is divided into the light emitting diode of a single individual.

[0013]Moreover, the configuration of a breakthrough according to claim 3 has the slant face expanded in the shape of a parabola as it goes to the outlet of a hole, and it is characterized by forming a reflective member in this slant face.

[0014]

[Embodiment of the Invention]Hereafter, based on a drawing, the surface mount mold ELD in this invention and its manufacture approach are explained. Drawing 1 is the sectional view of the light emitting diode which is the gestalt of operation of the 1st of this invention. Drawing 3 - drawing 10 are the explanatory views showing the manufacture approach of the light emitting diode of drawing 1. In drawing, the same sign shows the same member as the conventional technique.

[0015]In drawing 1, breakthrough 1with stage b which has crevice 1a is formed in the abbreviation center section of the substrate 1 which carried out the abbreviation rectangle configuration a different place from the conventional technique. As the breakthrough 1b is closed, translucency resin is filled up with and stiffened, and the translucency resin section 11 is formed.

[0016]Die bond is carried out so that LED7 may be covered to the crevice 1a side of a substrate 1 on the front face of said translucency resin section 11 and the side face of LED7 may be covered with the die bond paste 8 of translucency.

[0017]Wire bond of the top-face electrode of said LED7 and the electrode 4 formed in crevice 1a of a substrate 1 is carried out with the metal thin line 9, and said crevice 1a is made to fill up with and harden closure resin 10 so that said LED7 and the metal thin line 9 may be covered. What took into consideration

lightfastness, high reflexivity, heat dissipation nature, etc. as usual is used for this closure resin 10.

[0018]As for the light emitted from LED7, by the above-mentioned configuration, the light which escapes in a longitudinal direction by echo inside among the light left in the direction of the translucency resin section 11 can raise brightness by preventing reflecting on the wall surface of breakthrough 1b of a substrate 1 like an arrow head C, and escaping in a longitudinal direction.

[0019]Moreover, since the translucency resin section 11 is arranged in breakthrough 1b of a substrate 1, the conventional base substrate joined to the substrate 1 becomes unnecessary, and can make the part LED package a thin shape.

[0020]Drawing 3 - drawing 10 explain the manufacture approach of light emitting diode. Drawing 3 is the perspective view showing the processing process of a set substrate. In drawing 3, much 21 is a set substrate which consists of a glass epoxy resin taken and carried out. With processing means, such as for example, NC cut or a press, the processing approach of this set substrate 21 is on the flat surface of the set substrate 21, and it carries out two or more trains arrangement of two or more through holes 12 so that it may arrange in the shape of a grid. Moreover, breakthrough 1 with stage b which has crevice 1a is formed in the abbreviation center section between each train. Said through hole 12 is formed on the cutline X mentioned later, and becomes the side-face current carrying part of a semicircle configuration.

[0021]Drawing 4 is a B-B line sectional view after electrode pattern formation at drawing 3. In drawing 4, an electrode pattern formation process forms a deposit in the vertical side of the set substrate 21 which includes the inner surface of said through hole 12 by plating processing, it adds a plating resist, carries out exposure development with a pattern mask, performs pattern etching, and forms the through hole electrode 2 (current carrying part) the electrode patterns 3 and 4 and in said through hole 12 at said set substrate 21.

[0022]Drawing 5 is the sectional view showing the formation process of translucency resin, after it closes a hole with tape 13 grade at the rear face of said breakthrough 1b, makes the part of breakthrough 1b fill up with and harden translucency resin, and forms the translucency resin section 11. The tape 13 stuck after filled resin's hardening is exfoliated.

[0023]Drawing 6 is the sectional view showing die bond mounting and a wirebonding process, and on said translucency resin 11, with the die bond paste 8 of translucency, as it covers the side face of LED7, it carries out die bond of LED7 to the crevice 1a side.

[0024]A wirebonding process carries out wire bond of the top-face electrode of said LED7, and the electrode 4 formed in crevice 1a of the set substrate 21 with the metal thin line 9.

[0025]Drawing 7 is the sectional view showing a resin seal process, and after it fills up crevice 1a with closure resin 10 so that said LED7 and metal thin line 9 which were mounted may be covered, it is stiffened.

[0026]Drawing 8 is the perspective view showing a division process, and is divided into the light emitting diode of a single individual as shown in drawing 9 (perspective view by the side of luminescence), and drawing 10 (perspective view by the side of a rear face) by cutting along with the cutline Y which intersects perpendicularly with the cutline X which passes along the abbreviation core of the through hole 12 of the set substrate 21 by the dicing machine or the slicing machine, and this cutline X, and passes along the center between this through hole 12.

[0027]Like, by [ above-mentioned ] processing collectively and dividing light emitting diode into a set substrate, much picking production is possible and it is that the cost is cut down.

[0028]Drawing 2 is the sectional view of the light emitting diode which is the gestalt of operation of the 2nd of this invention. A different place from the gestalt of the 1st operation mentioned above is having slant-face 1c expanded in

the shape of a parabola as the configuration of said breakthrough 1b goes to the outlet of a hole, and having formed the reflective film 14 in this slant-face 1c by plating etc. as a reflective member. Since it is the same as that of the gestalt of the 1st operation about the other configuration and its manufacture approach, explanation is omitted.

[0029]By the above-mentioned configuration, as for the light emitted from LED7, the light which escapes in a longitudinal direction by echo inside among the light left in the direction of translucency resin 12 can reflect by the reflective film 14 formed in slant-face 1c of breakthrough 1b of a substrate 1 like an arrow head D, and can raise brightness further.

[0030]

[Effect of the Invention]As explained above, according to this invention, without missing horizontally the light emitted from LED, it is made to reflect efficiently and brightness is raised. Moreover, brightness can be made to raise further by making a breakthrough into a slant face and adding reflective structure.

[0031]Moreover, since a translucency substrate is not joined to a substrate, a thin LED package is obtained.

[0032]Moreover, in order for a set substrate to perform much picking production, the picking number is expanded and it is that the cost is cut down. Since the present mounting process can be used as it is, the manufacture approach by which had few installation costs and they were stabilized can be offered.

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#### DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is the perspective view of the light emitting diode concerning the gestalt of operation of the 1st of this invention.

[Drawing 2]It is the perspective view of the light emitting diode concerning the gestalt of operation of the 2nd of this invention.

[Drawing 3]It is the perspective view showing the processing process of the set substrate concerning the manufacture approach of drawing 1.

[Drawing 4]It is a B-B line sectional view after electrode pattern formation at drawing 3.

[Drawing 5]It is the sectional view showing the process which forms the translucency resin section in the breakthrough of drawing 4.

[Drawing 6]It is the sectional view showing the process which mounts LED on the translucency resin section of drawing 5.

[Drawing 7]It is the sectional view showing the process which closes closure resin to the crevice of drawing 6.

[Drawing 8]It is the perspective view showing the process which carries out the dicing of the set substrate of drawing 7.

[Drawing 9]It is the perspective view of the light emitting diode divided by drawing 8.

[Drawing 10]It is the rear-face perspective view of the light emitting diode divided by drawing 8.

[Drawing 11]It is the sectional view of the conventional light emitting diode.

[Description of Notations]

1 Substrate

1a Crevice

1b Breakthrough

1c Slant face

2 Current Carrying Part (through Hole Electrode)

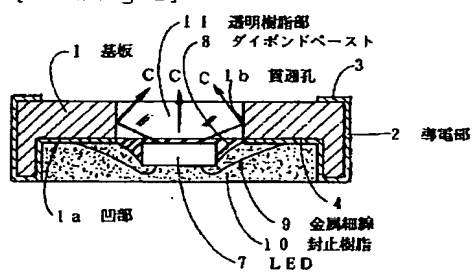
3 Four Up underside electrode

7 LED

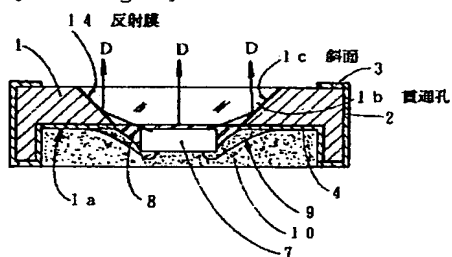
- 8 Die Bond Paste
- 9 Metal Thin Line
- 10 Closure Resin
- 11 Translucency Resin Section
- 12 Through Hole
- 13 Tape
- 14 Reflective Film
- 21 Set Substrate
- X, Y Cutline

## DRAWINGS

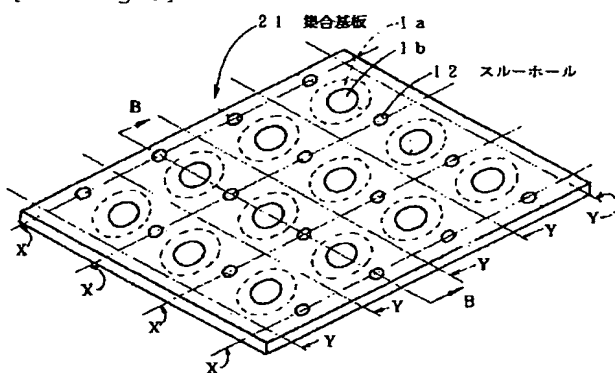
[Drawing 1]



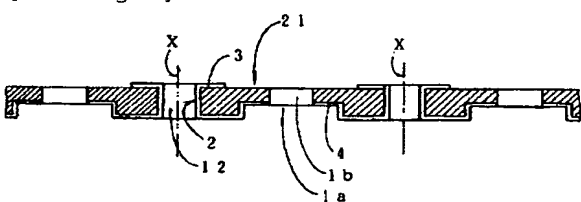
[Drawing 2]



[Drawing 3]

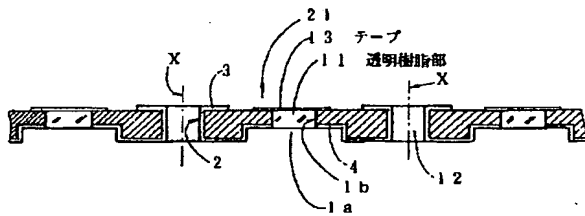


[Drawing 4]

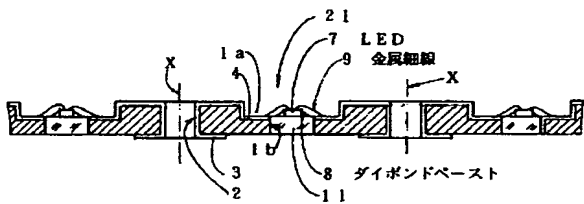




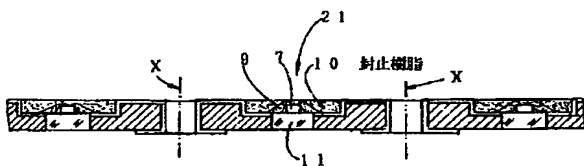
[Drawing 5]



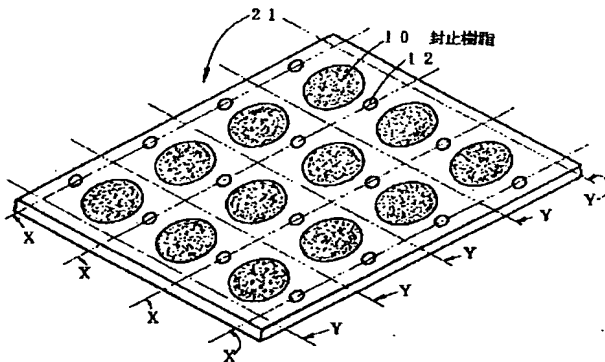
[Drawing 6]



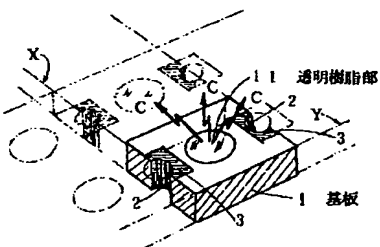
[Drawing 7]



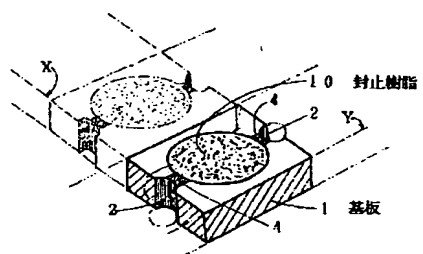
[Drawing 8]



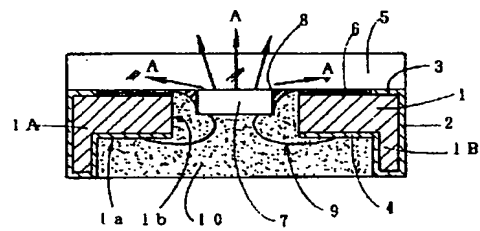
[Drawing 9]



[Drawing 10]



[Drawing 11]



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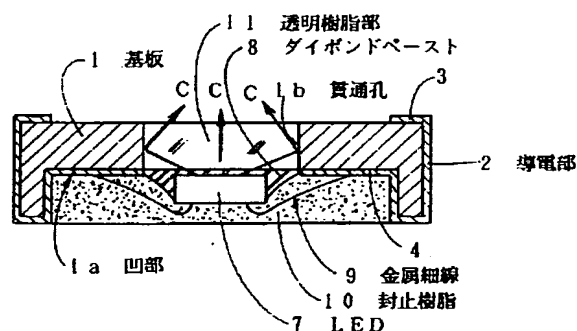
DA58 DA92

(54) 【発明の名称】 発光ダイオードとその製造方法

(57) 【要約】

【課題】 LEDの光が透光性基板を通して横方向に漏れて輝度が低下する。

【解決手段】 集合基板に複数個のスルーホールを複数列と、各列間の略中央部に凹部1aを有する段付き貫通孔1bを形成し、基板に上下面電極3、4と、スルーホール電極2(導電部)を形成し、貫通孔1bの裏面にテープ等で孔を塞いだ後、貫通孔部分に透光性樹脂を充填・硬化し、透光性樹脂部11の上にLED7を透光性のダイボンドペースト8でLED7の側面を覆うようにダイボンドし、LED7を金属細線9でワイヤボンドし、LED7と金属細線9を被覆するように凹部1aに封止樹脂10を充填・硬化する。集合基板のスルーホールの中心部を通るカットラインと、このカットラインに直交するカットラインに沿って切断して単個の発光ダイオードに分割する。また、貫通孔を斜面にし、斜面に反射膜を形成する。輝度がアップし、薄型で多数個取りのため安価になる。



【特許請求の範囲】

【請求項1】 側面の導電部で上下面の電極を接続している基板と、該基板の略中央部に凹部を有する段付き貫通孔を形成し、該貫通孔部分に透光性樹脂を充填・硬化して透光性樹脂部を形成し、該透光性樹脂部に発光ダイオードを透光性のダイボンドペーストで発光ダイオードの側面を覆うようにダイボンドし、該発光ダイオードの上面電極と前記基板の凹部に形成された電極とを金属細線でワイヤボンドし、前記発光ダイオード及び金属細線を被覆するように前記凹部に封止樹脂を充填・硬化したことを特徴とする発光ダイオード。

【請求項2】 請求項1記載の貫通孔の形状は、孔の出口に行くに従ってパラボラ状に拡大する斜面を有し、該貫通孔の斜面に反射膜を形成したことを特徴とする発光ダイオード。

【請求項3】 多数個取りするガラスエポキシ樹脂等よりなる集合基板の平面上にあって、格子状に配列するように複数個のスルーホールを複数列配設し、各列間の略中央部に凹部を有する段付き貫通孔を形成する集合基板加工工程と、前記スルーホールの内面を含む集合基板の上下面に電極パターンを形成する電極パターン形成工程と、前記貫通孔の裏面にテープ等で孔を塞いだ後、貫通孔部分に透光性樹脂を充填・硬化する透光性樹脂部形成工程と、前記透光性樹脂部に発光ダイオードを透光性のダイボンドペーストで発光ダイオードの側面を覆うようにダイボンドする実装工程と、前記発光ダイオードの上面電極と集合基板の凹部に形成された電極とを金属細線でワイヤボンドするボンディング工程と、前記実装された発光ダイオードと金属細線を被覆するように前記凹部に封止樹脂を充填・硬化する樹脂封止工程と、ダイシングマシン又はスライディングマシンで集合基板のスルーホールの中心部を通るカットラインと、該カットラインに直交しスルーホール間の中央を通るカットラインに沿って切断して単個の発光ダイオードに分割する分割工程とからなることを特徴とする発光ダイオードの製造方法。

【請求項4】 請求項3記載の貫通孔の形状は、孔の出口に行くに従ってパラボラ状に拡大する斜面を有し、該斜面に反射膜を形成したことを特徴とする発光ダイオードの製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は各種の電子機器に用いる発光ダイオードとその製造方法に関するものである。

【0002】

【従来の技術】 発光ダイオードには、基板に実装して透光性の樹脂で封止し、接続端子を設けることにより、回路基板への表面実装に適する形にパッケージした発光ダイオードのパッケージ構造として、例えば本出願人が先に特願2000-317237「出願日、平成

12年10月17日」がある。図11に基づきその概要について説明する。

【0003】 図11において、略矩形形状をした基板1は、ガラスエポキシ樹脂等よりなる樹脂基板で、側面の導電部2はスルーホールを略半分にした円弧形状をなした側面電極で、この導電部2で基板1上に形成した上下面の電極3、4を接続している。前記基板1の略中央部に凹部1aを有する段付き貫通孔1bが形成されている。前記基板1は貫通孔1bによって左右別体の基板1A、1Bに分割されるが、透光性のベース基板5で貫通孔1bを塞ぐようにして接着剤6等を用いて2つの基板1A、1Bに跨がって接合することにより、分割している2つの基板1A、1Bを結合する。

【0004】 前記透光性のベース基板5上で基板1の貫通孔1b内に発光ダイオード（以下、LEDと略記する）7を透光性のダイボンドペースト8でLED7の側面を覆うようにダイボンドする。前記LED7と基板1の凹部1aに形成された電極4とを金属細線9でワイヤボンドし、前記LED7及び金属細線9を被覆するように凹部1aに封止樹脂10を充填して硬化させる。

【0005】 前記透光性のベース基板5の材質は、例えばサファイアガラスやシリコンカーバイド等のように、透明で、且つ放熱性の良い材料であり、LED7から発生する熱を放熱する。

【0006】 また、前記封止樹脂10としては、例えばシリコン等のように耐光性で高反射性の白色樹脂が良く、更にこれにアルミナ等の粉末を混入すれば放熱性が向上する。

【0007】 上記した構成により、発光ダイオードは下面に形成された電極4により、組付け先の回路基板に表面実装される。図11に示すように、LED7から放出する光は、矢印AのようにLED7の側面から横方向に出るが、透光性のダイボンドペースト8と封止樹脂10の界面で反射して透光性のベース基板5から放出される。

【0008】

【発明が解決しようとする課題】 しかしながら、前述した発光ダイオードには次のような問題点がある。即ち、LEDから放出する光の一部が透光性のベース基板の横方向に漏れてしまうために、輝度が低下してしまう欠点があった。

【0009】 本発明は上記従来の課題に鑑みなされたものであり、その目的は、電子機器に使用される薄型で、輝度の向上ができ、且つ安価な表面実装型の発光ダイオードとその製造方法を提供するものである。

【0010】

【課題を解決するための手段】 上記目的を達成するために、本発明における発光ダイオードは、側面の導電部で上下面の電極を接続している基板と、該基板の略中央部に凹部を有する段付き貫通孔を形成し、該貫通孔部分に

透光性樹脂を充填・硬化して透光性樹脂部を形成し、該透光性樹脂部に発光ダイオードを透光性のダイボンドペーストで発光ダイオードの側面を覆うようにダイボンドし、該発光ダイオードの上面電極と前記基板の凹部に形成された電極とを金属細線でワイヤボンドし、前記発光ダイオード及び金属細線を被覆するように前記凹部に封止樹脂を充填・硬化したことを特徴とするものである。

【0011】また、請求項1記載の貫通孔の形状は、孔の出口に行くに従ってパラボラ状に拡大する斜面を有し、該貫通孔の斜面に反射部材を形成したことを特徴とするものである。

【0012】また、多数個取りするガラスエポキシ樹脂等よりなる集合基板の平面上にあって、格子状に配列するように複数のスルーホールを複数列配設し、各列間の略中央部に凹部を有する段付き貫通孔を形成する集合基板加工工程と、前記スルーホールの内面を含む集合基板の上下面に電極パターンを形成する電極パターン形成工程と、前記貫通孔の裏面にテープ等で孔を塞いだ後、貫通孔部分に透光性樹脂を充填・硬化する透光性樹脂部形成工程と、前記透光性樹脂部に発光ダイオードを透光性のダイボンドペーストで発光ダイオードの側面を覆うようにダイボンドする実装工程と、前記発光ダイオードの上面電極と集合基板の凹部に形成された電極とを金属細線でワイヤボンドするボンディング工程と、前記実装された発光ダイオードと金属細線を被覆するように前記凹部に封止樹脂を充填・硬化する樹脂封止工程と、ダイシングマシン又はスライシングマシンで集合基板のスルーホールの中心部を通るカットラインと、該カットラインに直交しスルーホール間の中央を通るカットラインに沿って切断して単個の発光ダイオードに分割する分割工程とからなることを特徴とするものである。

【0013】また、請求項3記載の貫通孔の形状は、孔の出口に行くに従ってパラボラ状に拡大する斜面を有し、該斜面に反射部材を形成したことを特徴とするものである。

【0014】

【発明の実施の形態】以下、図面に基づいて本発明における表面実装型LED及びその製造方法について説明する。図1は本発明の第1の実施の形態である発光ダイオードの断面図である。図3～図10は、図1の発光ダイオードの製造方法を示す説明図である。図において、従来技術と同一部材は同一符号で示す。

【0015】図1において、従来技術と異なるところは、略矩形形状をした基板1の略中央部に凹部1aを有する段付き貫通孔1bが形成されている。その貫通孔1bを塞ぐようにして透光性樹脂を充填して硬化させて透光性樹脂部11を形成する。

【0016】前記透光性樹脂部11の表面で基板1の凹部1a側にLED7を透光性のダイボンドペースト8でLED7の側面を覆うようにダイボンドする。

【0017】前記LED7の上面電極と基板1の凹部1aに形成された電極4とを金属細線9でワイヤボンドし、前記LED7及び金属細線9を被覆するように前記凹部1aに封止樹脂10を充填して硬化させる。この封止樹脂10は、従来と同様に耐光性、高反射性、放熱性などを考慮したものを使用する。

【0018】上記した構成により、LED7から放出する光は、透光性樹脂部11の方に出ていく光のうち、内部での反射で横方向に逃げてしまう光が、矢印Cのように基板1の貫通孔1bの壁面で反射して横方向に逃げるのを防ぐことにより輝度を向上させることができる。

【0019】また、透光性樹脂部11が基板1の貫通孔1b内に配設されるので、基板1に接合した従来のベース基板が不要になり、その分LEDパッケージを薄型にすることができる。

【0020】図3～図10により、発光ダイオードの製造方法について説明する。図3は集合基板の加工工程を示す斜視図である。図3において、21は多数個取りするガラスエポキシ樹脂等よりなる集合基板である。この集合基板21の加工方法は、例えばNC切削又はプレス等の加工手段により、集合基板21の平面上にあって、格子状に配列するように複数のスルーホール12を複数列配設する。また、各列間の略中央部に凹部1aを有する段付き貫通孔1bを形成する。前記スルーホール12は、後述するカットラインX上に形成されて、半円形状の側面導電部になる。

【0021】図4は、図3に電極パターン形成後のB-B線断面図である。図4において、電極パターン形成工程は、メッキ処理により前記スルーホール12の内面を含む集合基板21の上下面にメッキ層を形成し、メッキレジストを付加し、パターンマスクにより露光現像し、パターンエッチングを行い、前記集合基板21に電極パターン3、4と、前記スルーホール12内にスルーホール電極2（導電部）を形成する。

【0022】図5は透光性樹脂の形成工程を示す断面図で、前記貫通孔1bの裏面にテープ13等で孔を塞いだ後、貫通孔1bの部分に透光性樹脂を充填して硬化させて透光性樹脂部11を形成する。充填した樹脂が硬化後に貼付したテープ13を剥離する。

【0023】図6はダイボンド実装及びワイヤボンディング工程を示す断面図で、前記透光性樹脂11上で凹部1a側にLED7を透光性のダイボンドペースト8でLED7の側面を覆うようにしてダイボンドする。

【0024】ワイヤボンディング工程は、前記LED7の上面電極と集合基板21の凹部1aに形成された電極4とを金属細線9でワイヤボンドする。

【0025】図7は樹脂封止工程を示す断面図で、前記実装されたLED7と金属細線9を被覆するように凹部1aに封止樹脂10を充填した後、硬化させる。

【0026】図8は分割工程を示す斜視図で、ダイシン

グマシン又はスライシングマシンで集合基板21のスルーホール12の略中心部を通るカットラインXと、このカットラインXに直交し、且つ、このスルーホール12間の中央を通るカットラインYに沿って切断することにより、図9（発光側の斜視図）及び図10（裏面側の斜視図）に示すような単個の発光ダイオードに分割する。

【0027】上記した様に、集合基板に発光ダイオードを一括して加工し、分割することにより多数個取り生産が可能でコストダウンとなる。

【0028】図2は、本発明の第2の実施の形態である発光ダイオードの断面図である。前述した第1の実施の形態と異なるところは、前記貫通孔1bの形状は孔の出口に行くに従ってパラボラ状に拡大する斜面1cを有し、この斜面1cに反射部材としてメッキ等により反射膜14を形成したことである。それ以外の構成及びその製造方法については第1の実施の形態と同様であるので説明は省略する。

【0029】上記した構成により、LED7から放出する光は、透光性樹脂12の方に出ていく光のうち、内部での反射で横方向に逃げてしまう光が、矢印Dのように基板1の貫通孔1bの斜面1cに形成された反射膜14で反射して更に輝度を向上させることができる。

【0030】

【発明の効果】以上説明したように、本発明によれば、LEDから放出される光を横に逃がすことなく効率良く反射させ輝度を向上させる。また貫通孔を斜面にして反射構造を付加することにより、更に輝度をアップさせることができる。

【0031】また、透光性基板を基板に接合しないので、薄型のLEDパッケージが得られる。

【0032】また、集合基板で多数個取り生産を行うため取り個数が拡大されてコストダウンとなる。現行の実装工程をそのまま使用できるために、設備費が少なく安定した製造方法を提供することができる。

【図面の簡単な説明】

【図1】本発明の第1の実施の形態に係わる発光ダイオードの斜視図である。

【図2】本発明の第2の実施の形態に係わる発光ダイオードの斜視図である。

【図3】図1の製造方法に係わる集合基板の加工工程を示す斜視図である。

【図4】図3に電極パターン形成後のB-B線断面図である。

【図5】図4の貫通孔に透光性樹脂部を形成する工程を示す断面図である。

【図6】図5の透光性樹脂部上にLEDを実装する工程を示す断面図である。

【図7】図6の凹部に封止樹脂を封止する工程を示す断面図である。

【図8】図7の集合基板をダイシングする工程を示す斜視図である。

【図9】図8で分割された発光ダイオードの斜視図である。

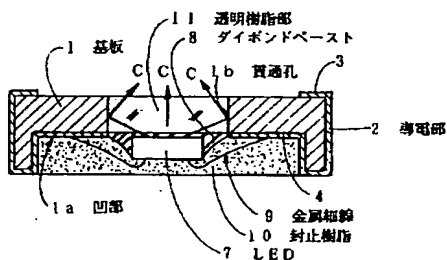
【図10】図8で分割された発光ダイオードの裏面斜視図である。

【図11】従来の発光ダイオードの断面図である。

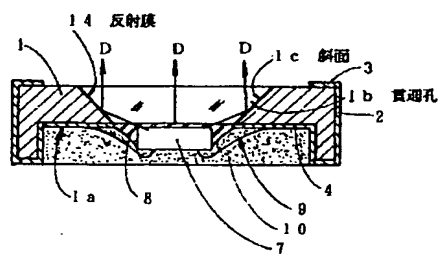
【符号の説明】

- 1 基板
- 1a 凹部
- 1b 貫通孔
- 1c 斜面
- 2 導電部（スルーホール電極）
- 3、4 上下面電極
- 7 LED
- 8 ダイボンドペースト
- 9 金属細線
- 10 封止樹脂
- 11 透光性樹脂部
- 12 スルーホール
- 13 テープ
- 14 反射膜
- 21 集合基板
- X、Y カットライン

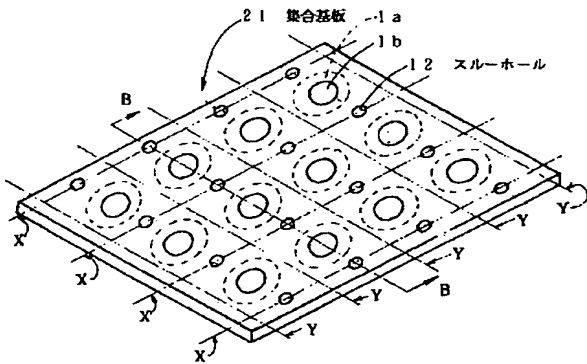
【図1】



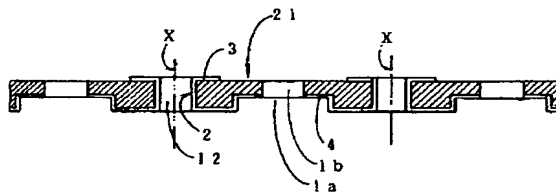
【図2】



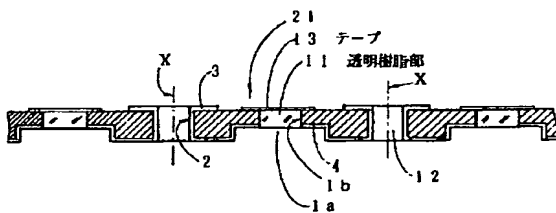
【図3】



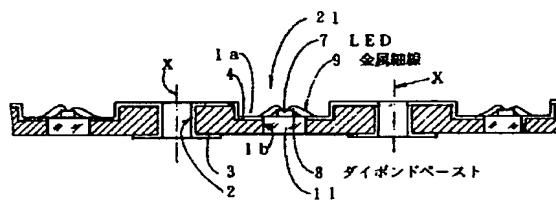
【図4】



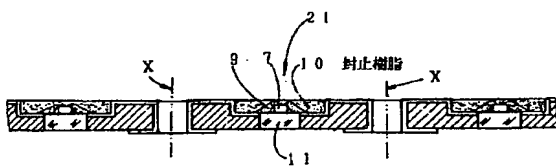
【図5】



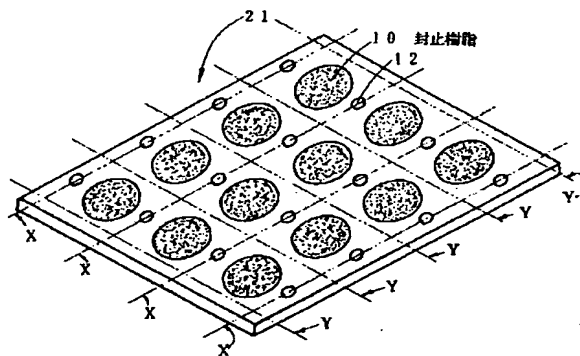
【図6】



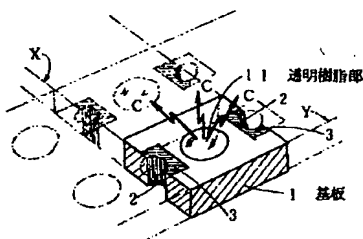
【図7】



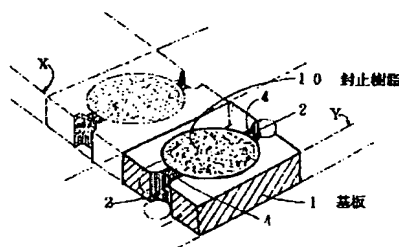
【図8】



【図9】



【図10】



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【図11】

